The Zillion Year Town

Nick Sharp
Edition 1

Nick Sharp
Curl Curl
New South Wales
Australia 2096
2014-Mar-22
Edition 1

#nickjsharp

"*The Zillion Year Town*" was written in Australia and often refers to local conditions, but could be adaptable to many other countries, with necessary variations for geography, society, demographics and climate. It would certainly need a drastic reworking for countries where land availability is low.

It is a derivative of my 2010 work "*A Zillion Year Plan … for humanity*" with some new ideas. It was written in the hope that some people might value a more concise description of The Town.

On re-reading my writings, I find myself always dissatisfied, probably the curse of any writer, but I hope the way of life it sketches is of interest to you. Neither this document nor The Towns (if any get built) will ever be complete, but perhaps it shows a way forward that allows humanity to continue a relatively pleasant existence into the far distant future. Continuing as we are now is the way to catastrophe.

The Zillion Year Town can be downloaded in PDF form from:
https://archive.org/details/TZYT1

and the earlier work *A Zillion Year Plan...for humanity* in PDF form from:
https://archive.org/details/AZillionYearPlan...ForHumanity

Table of Contents

The Challenge

Life on earth is utterly dependent on the sun. It has fuel for another 5 billion years, but surprisingly (after already burning for about a similar time) it is *still* heating up, and is predicted to be about 10% hotter within another billion years. That is probably too hot to sustain life on earth any longer. So maybe life can continue for about another 100 million years. Who knows? Let's just call it a zillion years and consider what humanity has to do, not just to survive for that time but to live well.

Of course, there is always the possibility that life, or at least human life, will be wiped out if the earth is struck by a huge cosmic object, or there is a massive volcanic event, or a killer disease occurs. There is very little we can do about the first two, though if we spent less on armaments and war, and more on medicine, we might be better placed to fight the last.

However, it is certain that humans will either disappear or fail to live well if we continue to ignore the rules for an ***indefinite*** existence on a ***finite*** planet. Here are some of the main ones:

1. Don't use *up* non-renewables (not don't *use* them; that would be most unacceptable). They have to become treated not as consumables but as valued assets to be reused, or at worst totally recycled
2. Don't wipe out fragile renewables by over-harvesting, pollution, or habitat destruction. Don't fish till the brood stock has gone. Don't clear fell timber, especially on hillsides in rainy areas
3. Nurture the land, the waters, the atmosphere, and just about every living species

All those are currently being broken massively by many of us. We have, bit by bit, to reconstruct our entire society to achieve *indefinite total sustainability.* This document describes one possible solution - a new style of town - that should be prototyped soon.

It unapologetically presents a solution without a detailed explanation of the problem, because that is simple to state, as above, and has frequently been discussed elsewhere. But briefly ...

The first challenge

Tackling human-caused global warming is the *second* biggest challenge facing humanity today.

Achieving total sustainability is the *first*, and includes the former.

For example, we should stop burning fossil fuels or we will change the climate of the planet in ways that will devastate our way of life. Some people do not accept that, but they must accept the arithmetic that we *will* stop burning fossil fuels if they run out. Those of us who accept the science of global warming will argue that we must stop burning fossil fuels long before that, referring to *unburnable carbon*.

We are actually heading for running out of all sorts of non-renewables within the first half of the 21st century, and we are wrecking various renewable supplies at a terrifying rate, losing soil, despoiling waters and wrecking fisheries, polluting air, and sending more species extinct faster than ever before.

It is time to start the change before it is too late.

Rules for indefinite living

Earth is a finite planet and many resources we use are non-renewable. Some materials are destroyed by using them (fossil carbon fuels, uranium) and can never be recovered.

In most other cases, materials are not actually destroyed but are usually irretrievably dispersed into the environment, whether to land fill, the waters or the atmosphere, often causing pollution. Mining and extracting them use up other non-renewables and often create huge amounts of waste and pollution.

So we must begin to obey those rules above. In particular, we must begin to treat all non-renewables as *assets* to be reused and recycled indefinitely, not as *consumables* to be thrown away after a single use.

Cities and suburbs

It is my contention that our city/suburban lifestyle is substantially to blame. Dazzled by *apparent* economies of scale, we have created vast city-suburban complexes. Their efficiency is an illusion, propped up by consumption of non-renewables, both during construction and maintenance of their physical infrastructure (steel, concrete, glass, marble, tar, plastics, and many other materials), and during operation (uranium, oil, coal and gas for power and transport), so those complexes are unsustainable.

Sometimes they are also shown to be non-resilient. A power failure shuts down the traffic lights bringing gridlock to the city streets and rendering high rise buildings unusable for lack of power to the lifts. A crash in a key tunnel blocks a major road and much of the city's road traffic halts. A fuel shortage shuts down just about everything; no fuel – no tractors on the farms and no food at the supermarket.

Sadly, March 12th 2014 gave several demonstrations. An electricity switch tripped shutting down Darwin for 12 hours, inconveniencing nearly 130,000 people. A “massive underground fire broke out at Sydney's Barangaroo, closing major roads and forcing thousands of people to be evacuated from nearby buildings.” (Sydney Morning Herald). A gas leak in East Harlem is suspected of causing a massive explosion which felled two apartment buildings, injuring many, killing several, and shutting Grand Central Terminal.

In the longer term (perhaps a few centuries) since many cities are coastal, they *will* be under water *if* global warming melts the Greenland and Antarctic ice caps, adding ~70 metres to current sea level.

Cities and suburbs: unsustainable, non-resilient, and eventually perhaps, most submerged below sea level.

The solution

Tree change?

Some advocate a "tree change", each single family dwelling on a modest amount of land, hand-rearing crops, poultry and small animals. It is a way of life that appeals to those with the necessary energy and persistence, but it is quite inefficient overall, and starts to unravel when there are children to educate or sick folk to cure. We are a social and gregarious species that excels through cooperation.

Scale

The problem is one of scale. We grab opportunities to carry out activities allegedly more efficiently on a larger scale, but fail to discern the *dis*-economies of scale. For example, as a city grows outwards, it:

- obliterates fine agricultural lands (sometimes rich market gardens) at its borders and thus ...
- distances itself even further from the remaining food-growing areas and ...
- increases all transport needs, for commuters, food, raw manufacturing materials and wastes

The Town

My solution is ***The Town***, a new and significantly different structure aiming to provide an excellent and comfortable way of life whilst recognising and obeying the rules of indefinite existence on a finite planet.

The Town would be big enough to scale services such as education and health up to an efficient level, but still small enough to walk or cycle. Smaller roads, less cost, no cars, no fumes, no drives, no tragedies.

In The Town, conventional city/suburban massive infrastructure would be replaced largely by distributed systems for water, sewage, electricity, heating, waste water disposal, and storm water soak-aways.

Questions

Some of these key questions are tackled below. You may have more:

- What should be the population and land area of each Town
- Where should they be located
- How should they be governed
- How should education and health services be provided
- How should the residents be housed
- How should people travel, within and beyond The Town
- How should they communicate
- What internally focussed work should they do
- What goods and services should they provide for export
- What goods and services should they import
- How would it be financed
- What are the risks to its indefinite existence
- Is its overall philosophy sound

If you don't agree with the need for total sustainability, I cannot help you. I think you must have complete faith in "*they* will think of something" or "the technology will come along to fix everything". We *will* hit the brick wall when the non-renewables run out, over consumption of the fragile renewables wrecks their supply, and failure to nurture almost every aspect of our environment leaves much of the planet an unproductive ruin.

If you don't agree with my solution, I look forward to reading yours. I'm serious. If you think my solution is wrong, say why, and try to frame an alternative. There is not much time left.

I have no illusions that The Town is a perfect society, a *utopia*. In fact, if you read Sir Thomas More's work Utopia, where he invented the word, you find the society he describes includes aspects that could not possibly be considered perfect, such as slavery, mercenaries fighting its wars, and the death penalty.

Size, shape, location and Town structure

Population and land size?

The answers are not hard and fast, as location and many other circumstances will significantly influence them. My estimate, based on the needs of key social infrastructure, is a population somewhere in the 10,000 to 20,000 range and an overall land usage of approximately one hectare per person, mostly for food, fibre, forestry and wilderness. Taking the mean of 15,000 residents consider the following ... Assuming the Australian average house occupancy of about 2.5 people per dwelling, 15,000 people would need about 6,000 dwellings. Let us allocate an area of 1,000 square metres per dwelling, *including* all

public space, which probably amounts to half the area, so the actual space per dwelling would be 500 square metres, which is neither over-generous nor exiguous. Units would need less. Thus the size of The Town's domestic and commercial area might be about 6M square metres, which is 6 square kilometres.

That should perhaps be a semicircle of about 4km diameter, thus average domestic area journeys should be within the capability of most people to walk or cycle/skate/scoot, thus eliminating the need for cars. Some more senior or disabled folk would find electric wheelchairs, adult tricycles or a tricycle rickshaw service more acceptable. Batteries and electric motors to supplement human power would be appropriate.

The diameter should be located parallel to a highway (and hopefully rail line), but set back to reduce noise and pollution, and serviced by a feeder road.

If the climate science worst case is true, sea level will rise about 70 metres over the next few centuries, so the location of each Town should be chosen to be at or above that elevation.

The interface

The diameter is the physical interface between The Town and the highway. All buildings for commerce, light industry, traveller accommodation, and vehicle garaging would be located there, with twin access:

The domestic side facing doors would be for residents arriving on foot or human-powered vehicles. There would need to be bicycle parks, both much smaller and safer than the usual huge car parks at malls.

The highway outward facing slip roads and loading bays would access the feeder road. They would be used by service trucks, Town vehicles going to and from the highway, and by vehicles from the highway pulling off to access fuel, food and accommodation services.

As *all* buildings requiring highway vehicle access would be at the interface, there would *never* be any through traffic within The Town. Occasionally, Town service trucks and other vehicles driven by Towns-folk would carefully and slowly use the domestic roads, rendering them safe for all. A few out-of-Town drivers (eg disabled services) might be allowed (with guidance) on the domestic roads when essential.

Domestic area

The entire area behind the interface buildings would be the domestic area: houses, units, aged care, parks and gardens, and community facilities (such as halls, churches, sports fields). A few clinics might be distributed around inside The Town for ease of patient access, but there would also be a modest hospital, which would probably need to be located at the interface as it might sometimes need to serve injured patients arriving from the highway, or to use the highway to transport some patients to other hospitals.

A major swimming pool complex would be located somewhat centrally in the domestic area as it would have no great need of highway access. Individual residence swimming pools should probably only be allowed if they are above-ground and relocatable, and fully secured for child safety. Perhaps there should not be *any* individual swimming pools. Too many infants have died in them.

Land for food, fibre, forestry and wilderness

The Town *must* have enough land outside the domestic area for production of its food, soft fibres, and timber, with a substantial wilderness area beyond - linking with similar areas of neighbouring Towns to create a trans-continental wildlife refuge. There should be a service road just beyond the domestic area.

Today a huge *virtual* component of our food is not proteins, carbohydrates or vitamins, but oil to power tractors, harvesters, trucks for transport to distant wholesalers and retail outlets, and petrol for cars to take the shopping home; and oil and gas are used to make much of the fertiliser needed by current agriculture.

The fossil fuel component of food (and fibre and timber) must eventually be nil. The Town helps reduce

all but on-farm fuelling. Elimination of fossil fuels from the farm itself will be difficult. Obviously, as in past centuries, it could be replaced by appropriate intermediate technology tools and human and animal muscle power (unlikely to be popular choices) or by current or future technology but powered by bio-fuels instead of fossil fuel. The challenge of bio-fuels is that its production *might* compete with other land uses, unless the demand is low enough that it can all be made from bio-waste. There are still considerable remaining sustainability issues both with making farm equipment and the bio-fuel generation apparatus.

The phrase “food miles” is increasingly common, with the correct implication that less is generally better. But as fossil carbon materials run out, we must also reduce, and eventually eliminate our dependency on them for running agricultural machinery, making fertilisers, and importing non-renewable phosphates.

We also need crops for fine fibres (clothing and other textiles) and for wood, for construction of dwellings and furniture. We cannot rely for much longer on artificial fibres or plastics made from oil, as it runs out.

We must make more and more use of timber products, often composites rather than just pure wood, for our housing and furniture, as the currently preferred but non-renewable materials either run out (oil-based) or become increasingly difficult to make without unacceptable carbon emissions (such as steel, if it is made from the iron ore with coke as the reducer).

We will lose our country's natural heritage unless we also allow a portion of land to be devoted to its native flora and fauna, and in a way which allows such portions from nearby Towns to link up with each other, creating wildlife corridors that span the continent.

In Australia, some 6% of the ~7.7M square kilometre land mass is used for arable crops in a nation of 23,000,000. That seems to be about 2 hectares per person, though in fact much of it grows crops currently for export. Whether the country can continue with such exports is an important question for another work: what ships and what fuel? Whether The Town should export much food produce is another question for the future, but let us guesstimate that, per person, there should be about one hectare in all devoted to food, fibre, forestry and wilderness, spreading out in that order from the domestic area, like onion rings. That would make the entire Town about 15,000 hectares, or about 12km x 12km if square.

Food production will need the greatest amount of effort, so it should be nearest the domestic area, leading to easier transport of staff to the fields, produce to the shops, and organic materials from the composting toilets (see *Houses* later) to the land. Next comes soft fibre production, whether it be from cotton, sheep for wool, industrial hemp (no drug content!), flax, silk, or whatever textile fibres are appropriate. Forestry probably requires the least regular attention, so can be the furthest cropping area, followed by the wilderness area, which is at the outermost so that it can link up with the similar areas of neighbouring Towns eventually to create transcontinental wildlife corridors.

The areas for each land usage might vary over time. For example, smart cultivation with great attention to soil health might eventually lead to a reduced need for food land, allowing fibre production to expand, or for the domestic area to increase. Initial Town land quality may be poor, which will impact the strategy for allocating land to the four uses, a strategy that will vary with time and good cultivation.

The increasing scarcity of mobile fuels and artificial fertilisers will probably lead to some major changes in the way we do agriculture. We may need more human labour, different growing techniques such as more permaculture and pasture cropping (a.k.a. no-till farming), and compost-based organic production. This is why the food areas should be sited on the very outskirts of the domestic area, for ease of access. In addition to minimising the need for mobile fuels, cultivation must improve the soil quality, and ensure as far as possible that soil nutrients are not lost through run off. This could be a major challenge for The Town in its initial years, as it is quite likely that it would be constructed on marginal land, which it would need to convert into a rich and fruitful area, thus reversing decades of degradation by over-exploitation.

Sister Town

A sister Town should be sited on the opposite side of the highway, with underpass access between them. It would be an independent Town, but the doubled (~30,000) overall population could justify some larger shared institutions, such as a higher level hospital, entertainment complex, or museum. Relations between the Towns would range from cooperation on many projects to friendly sporting rivalry!

Education

Education is the activity which involves more of the population than any other. One in six are pupils in the range kindergarten to end of high school, and since education really should begin from the very first years of life (informally or in pre-schools), it could be argued that a full quarter of the population are pupils. Add the time of parents, and teachers and all the associated staff, and probably about 30% of us are involved (part or full time) in education, even more when we consider tertiary educational institutions.

So how viable is kindergarten-to-high-school education in a town of 15,000 citizens? There would be about 2,600 pupils in that cohort, or approximately 200 per year. There should probably be several pre-schools and co-located primary schools distributed around The Town, and perhaps a single co-located complex of junior and senior high schools with 10 form entry (assuming a class size of 20 pupils). I believe that most educators would find those numbers quite attractive when considering whether it allows for efficient and excellent provision of schooling, including wide subject coverage. The secondary complex age break might be junior 5-8 and senior 9-12, as current primary pupils 5-6 should perhaps be in junior high instead, and senior pupils need a different approach, particularly to discipline.

A primary and secondary school system with about 130 classes overall might require about 160 teachers, so there should be good opportunities for teachers' career development solely within The Town. It is probable that The Town's education system would attract pupils from outlying small towns and villages.

Some universities alone have more students than the suggested 15,000 population of The Town, so it is certain that it would not host a full university, but it is likely that there would be adjunct departments of distant universities, particularly those devoted to the study of the social, financial, agricultural and environmental aspects of The Town itself. Superb communications means today's universities are more distributed multi-campus organisations anyway, even those not specifically dedicated to distance learning.

Health

The ratio of doctors per 1000 of the Australian population is about 2 or 3, so a population of 15,000 might support some 30 to 45 doctors. One might expect about a similar number of other medical staff such as radiologists, dentists, physiotherapists, administrators, and so on. (Many tiny towns (<~250) fail to have even one doctor in their midst, or s/he is the only doctor, sometimes ageing, who struggles to find a locum for a holiday, or actually be sick! There might be no other local health professionals either.)

Such a medical and resident population could allow a few efficient and well-staffed small medical centres in the domestic area, and a small hospital at the interface. If there is a sister Town, roughly doubling the population served, a much more substantial a hospital seems probable. The life style that would be automatic within The Town (more physical exercise) might however lead to such an improvement in overall health that the call on health services would be a lot less than now. Most health issues would start with a brief online video consultation - a remote triage - to ascertain whether the patient needs to visit the doctor, or vice versa (house calls!). Such processes could lead to the elimination of a great place to waste time and share germs – the doctor's waiting room!

Houses

Single storey

The majority of houses could be single storey. Roofs would collect both rain water and sunlight, so a high ratio of roof area per person is preferred. Sunlight would be collected as:

- electricity using photovoltaic (PV) panels
- light, via skylights, or directed by fibre optics to darker areas of the house
- heat for solar space and water heating, either directly using thermal panels on the roof, or through use of a heat pump, thus taking solar power indirectly from the air, leaving more roof space for PV

Passive design house structure would be essential, and would reduce or eliminate any need for active space cooling or heating. Houses should be prefabricated in an indoor (therefore all-weather) factory environment, leading to highly efficient and very rapid, low waste, erection.

To minimise the footprint of foundations, houses could be built on steel earth screws. These could later be unscrewed, so a decision to revert a built area to park or crops would be easy. The steel screws would be recyclable and might even be reusable. The floor would be set at about a metre above soil level, thus providing some protection against minor floods, and allowing underfloor space to be used unobtrusively for large water storage tanks. Access to the house from ground level would be via wooden ramp, wide enough for bi and tri-cycles. Also below the house would be organic material collection hoppers since ...

Composting toilets

...*all* toilets, without exception, would be composting toilets. Each would have an externally accessible collection hopper sited in the underfloor space of each dwelling. Unless residents prefer to compost their kitchen wastes in the garden, all organic waste from the kitchen would also be added to the toilet. A full hopper (contents already semi-dried, and part-processed by manure worms) would be swapped out for an empty hopper by a town truck, and the contents processed and used on the agricultural lands. This helps close the phosphate cycle, and thus avoid the threat of peak phosphate. It is also a reason why The Town might be reluctant to be a continuing net exporter of food, as that would require importation of mineral phosphate, a non-renewable which will become increasingly scarce and of doubtful quality.

Peak phosphate is as real a concern as peak oil, though perhaps a little further off. The processing of phosphate rock is also an environmental issue. It uses up sulphuric acid and generates gypsum (calcium sulphate) of a quality that makes it unusable for any other purpose, since it is usually slightly radioactive.

A properly designed composting toilet system includes a fan to maintain a permanent gentle air flow from the room, down into the toilet pedestal, over the material in the hopper, and up through a small pipe to a vent above the roof, so there is no chance of any smell within the house. This would also tend to dry and thus shrink and lighten the materials.

The use of composting toilets is another reason why houses should mostly be single storey. It *is* possible to fit such a toilet to a second storey using a high wide shaft to a hopper below the ground floor, but it is not an attractive construction. A two storey house might of course simply not have a second floor toilet.

A composting toilet reduces by at least 30% the use of water, and enables the complete elimination of public sewage systems. The house waste water is now 'light grey' instead of 'black' and can be disposed of by subsurface irrigation in the garden. There are no sewage pipes leading to the street, no street

sewage pipes or pumps, no sewage processing plants, no ocean outfalls (so no health risks for swimmers), and no concerns about storm water entering the sewage system and causing overflow, as inevitably happens when tree roots or subsidence cracks sewer pipes, or where illegal connections are made from gutters to sewers. The savings could be enormous. My area's local water authority recently spent AU$70M on a sewage detention tank, to try and ensure no storm-time sewage system overflows.

The water for the house is collected from the roof and stored below the floor in substantial tanks. A pump is needed to raise stored water perhaps to a high tank in the loft, to provide gravitational pressure. However, that does not provide the sort of water pressure that people have come to expect in these days when high pressure mains are connected directly to taps and hot water systems. In fact countries such as UK used to mandate running the mains into a high-up reservoir tank using a ballcock-controlled outlet that made it impossible for any back flow from the house into the mains. Perhaps the supply tank should be sealed, thus allowing the pump to build up more than gravitational pressure using an air buffer, in which case the tank does not need to be high up at all, and can also be underfloor. The pump would be an excellent monitoring aid. Measuring the electricity it demands would give a real-time report on usage. Residents desiring fluoride for dental health should use a fluoride toothpaste.

Water devices (taps, shower heads and so on) in the house should be water savers, thus further reducing water usage beyond the massive 30% avoided by composting toilets. A target of 50% seems reasonable. Good water usage habits are also important. A modest example is to have a dilute soap gel dispenser at the basin. Thus hands can be washed initially just using the gel before rinsing under the tap, instead of turning on the water to wet the hands and rub them with the dry soap cake, often then leaving the water running vigorously whilst washing the hands. Turn off the shower water whilst shampooing or soaping. Multiplying such water savings by many times a year and many millions of people gives a huge volume.

There are no water mains to the house or in the street, so no pumps, no processing stations, no pipelines, and no reservoirs occupying land that would have been fit for agriculture, forestry, or housing. There can be no system-wide health threats such as from giardia or cryptosporidium infections (Sydney, others). It is conceivable that as a worst case contingency a water truck would have to visit a house and run out a hose to refill the house tanks. Such a water truck might be required anyway for agricultural functions.

The collection of all roof water, coupled with the much lower hard surface coverage per house (no drives or car ports, and much smaller road surfaces) should allow the use of roadside swale drains (grassed concave trenches) to handle storm water, thus avoiding the need for any buried storm drains. There is no need for roadside pavements as the road is itself a shared pedestrian/cyclist space. The swales would absorb most of the water, which might be used by small fruit trees planted there.

Gardens

Garden style offers a further water saving approach. Evolution has ensured that many native Australian species have low water demands, and mulching increases the drought resilience of a garden of natives. The underground grey water disposal outlet could be sited near the more water-demanding shrubs and trees. If houses back on to shared park land, with access, perhaps omit lawns altogether in domestic gardens. There would be no need ever again to mow or trim edges! And leaves would mostly fall onto mulched space, not lawns or drives, thus avoiding any desire for noisy, petrol leaf blowers. At last, a quiet Sunday! Pleasant sitting areas could be created with large pavers, and children can safely run around in the shared park land, parents knowing that the roads are always free of dangerous traffic. The park land grass could be kept low by grazing animals, such as wallabies in Australia or sheep etc elsewhere. There should not be any pets that are either likely to go feral or to interfere with the grazing animals. Australia, for example, has an appalling record of pets going wild. There are about as many feral cats as there are humans on the continent. The slaughter of native animals is millions *per night*.

Mains

Electricity

Advances in domestic battery storage of photovoltaic-captured electricity might eventually make electrical mains unnecessary, though they would offer:

- Supplementary power to the house PV system when needed (such as storage absent or empty)
- Outlet for selling surplus PV power when available
- Immediate standby in the event of PV system failure

Any distantly supplied mains electricity should be generated from wind, solar PV, concentrated solar power with storage, or hydro. The Town might have some of its own wind turbines, and possibly a small solar PV farm to supplement roof PV. An electrical mains system should be entirely underground. Apart from improving the visual amenity, this avoids the street hazard and bush fire potential of power poles.

Communications

Digital wireless technology is progressing at such a pace that it is hard to know whether The Town would in fact need *any* physical communications medium. If it did, that would undoubtedly, for several decades forward, be fibre optic cable to the premises (FttP). In this document it is not intended to debate that choice, which is partly tied up with the issue of whether mains electricity is to be supplied, since both mains electricity and fibre communications provide cross-justification of buried supply methods; if the cable had non-conducting nylon (not metal) strengthener, it could run in the electrical ducts. Omit one and the cost of burying the other is no longer shared. It is probably cheaper to deliver services via wireless than via fibre; the challenge is whether wireless is adequate. It is inherently a shared medium subject to errors whereas FttP can provide huge, dedicated, and almost entirely error-free connections.

Mobile telephony and localised wi-fi are of course wireless, but this is not true for other services, some of which would be very bandwidth-intensive. The prototype Town choice should probably be FttP.

Whether the main medium to the home is fibre or wireless, there would be wireless services anyway, for mobile telephony, and wi-fi network computing, in these days of ubiquitous tablets and smart phones.

Services could include:

- Land line telephony – though perhaps its days are numbered
- Mobile telephony – access charge but no in-Town call charges?
- Free to air and cable TV – no aerials anywhere; instead channels rebroadcast locally by agreement
- Internet – high bandwidth in and out, including email
- Video conferencing: work, social, medical functions
- Video on demand: eduction, entertainment
- Monitoring: water store, energy usage, temperatures, equipment functioning, toiler hopper level

Most or all such services should probably be unmetered within The Town (no local usage charges). Excellence in communications would be an essential enabler of many social, educational, entertainment, medical, and work opportunities envisaged for The Town.

It is quite possible that technology improvements (both to domestic-scale electrical storage and to wireless networking) mean The Town might find no need for either sort of mains services. That would be welcome as it would further shrink the infrastructure costs and avoid all underground work.

Gas, water, sewer, storm

There would be *no* other mains services. Fossil fuel gas is entirely inappropriate, and the concept of

central generation and mains distribution of biogas would be pointless to The Town, though it might have a place in some cities where water-born sewage provides automatic collection of fermentable material.

Occasionally, there would be some justification for bottled gases, such as for welding or metal plumbing work. It would be interesting to see the development of an entirely electrical barbecue so that this piece of kit, deeply ingrained in the Australian way of life, could become emissions-free, once the electricity is no longer derived from fossil fuels. I'm not sure how to make an electrical flaming grill! Avoiding any bottled flammable gas domestically is a great safety benefit. I witnessed what could have become a very bad event. However, barbecuing might disappear if a less or non-carnivorous diet becomes unavoidable.

No street water systems (mains, sewers, storm drains) are needed thanks to roof collection of water and use of composting toilets, thus dropping waste water quality from black to grey, and therefore permitting local disposal by subsurface irrigation instead by sewer. Shrinking the roads to half normal size, eliminating drives, and total roof collection, replaces the need for storm drains by simple swale drains.

Equipment

Whilst there should be no bar to owning any legal appliances, it would be better if most of the equipment used in houses and offices were to be leased: refrigerators, washing machines, dishwashers, kettles, toasters, mixers, TVs, computers, Hi-Fi systems and so on. Indeed many such items (such as hot water systems and built in cookers) would simply be provided as part of the house lease.

The leasing company then has a strong incentive, by astute purchasing, to ensure items:

- last for as long as possible
- are selected such that they can be maintained relatively cheaply and easily
- excellent supplies of spares
- maintenance guides easily available free via the Internet
- upon reaching final end of life, can be dismantled completely into reusable components or recyclable materials, thus avoiding all waste disposal

The householder then has no concerns about breakdowns, repairs, or end-of-life disposal. They are the lessor's responsibility to fix and finance. Items purchased elsewhere by residents might not be easily maintained in The Town, as the leasing companies would be set up mostly to repair those products it has chosen, assuredly with resident input. There would be no need for residents to maintain records about leased items, unlike for purchased items where date and proof of sale is necessary to invoke guarantees.

A similar approach could be taken to conventionally powered or electric vehicles. Few residents would have regular need of these anyway, unless their occupation took them outside The Town daily, such as an area doctor, nurse or vet. Such vehicles would be garaged near the highway, not in domestic residences, which would thus need no drives, carports, or garages. Those who required daily access to an owned or leased vehicle might well seek to live in a house or unit quite near one of the interface garages. A few vehicles used on the agricultural lands would best be kept at the border between the domestic area and the food growing area. There would be a border service road, with access to the highway feeder road, for ease of transporting produce to processing stations next to the highway without transiting The Town.

ICT (Information and Communications Technology)

There would be a Town data centre and local telco. It would provide mobile telephony, and many of the facilities of an ISP (Internet Service Provider) with distant connection to the Internet. If all connections were to be fibre optic, domestic connection speeds could be massive, for both up and down loads. Data used within The Town might not be charged.

Residents might choose to use open source computing products for their own work, as these now fully rival proprietary products in performance, but at no financial cost to the end user. Typically they also seem to be a lot less subject to virus or other hacking attacks. This document was planned using FreeMind (mind mapping software) and written using LibreOffice Writer running on Ubuntu Linux.

Mail boxes

One way of avoiding paper junk mail is to have *no* residential mail boxes! There would be post office boxes for all, so that all paper mail or parcels can be accepted, and a "You have snail mail" email notification sent! Residents would soon encourage correspondents to use email instead of paper mail.

The post office boxes might need to be invisible to the sender, but deduced upon receipt in The Town's post office. Thus firms which refuse to deliver to post office boxes would simply see a resident's name and a standard street address (that of the post office!) and would send anyway. The post office could trade the absence of a delivery service for free post office boxes.

In some countries, the absence of a mail box would disable delivery of newspapers too. In Australia it is common for newspapers (trees) to be individually wrapped in polythene sheeting (oil) and thrown at the drive. My suggestion would be for residents to abandon news *papers* and switch entirely to online news services, at least some of which are still free. The environmental savings would be considerable.

Refuse collections?

One of the greatest goals of The Town is that there shall eventually be no such thing as refuse, so perhaps it would be good from the beginning to abandon traditional kerbside collections. Instead residents would take unwanted materials to a reuse and recycling centre (R&R Centre), where they can be guided in its sorting or eventual reduction/elimination.

Such an omission might seem to be a massive inconvenience, but perhaps there should be no regular collection of unwanted materials, such as by truck picking up from large bins. Granted, in many countries standards have risen such that only a small bin is available for complete trash, with recyclables bins for paper, product containers, and garden waste - perhaps including kitchen compostables. However, if residents were personally responsible for disposing of unwanted materials, it might begin to happen with near 100% accuracy and in much smaller volume, since personal effort would then go into avoiding those materials at source, by reusing containers for many products, and avoiding wastefully packaged items.

After all, nearly all domestic waste originates at the shops, and has a volume somewhat less, and a weight significantly less, than the purchased items. So, put all unwanted items in a cycle-attached shopping trolley and take it to the R&R on the way to make new (preferably lightly/zero packaged) purchases. Critics might argue that such a policy would lead to dumping. That might be the case in a more conventional society, but The Town, particularly the prototype, would be populated by those fervently dedicated to a sustainable future, who by their philosophy would hopefully behave in the correct way.

There would be challenges; it is not clear to me how best to cope with soiled infant nappies or adult incontinence pads. Busy carers welcome the ease of use of disposables. There are some environmental downsides to laundering cloth nappies. Perhaps there are modularly structured products that allow perpetual reuse of a plastic component and toilet disposal of compostable paper-based soiled items.

Ownership

The Town would be owned principally by its residents, who would hold it in the form of shares. No corporations would be allowed to own Town shares other than Town-related superannuation companies.

Otherwise, out-of-Town shareholdings would be limited to those intending to take up residence, those who had recently left The Town, or deceased estates. Sale either of shares or an investment property is normally subject to a capital gains tax (CGT), whereas sale of a principal residence is normally (below a luxury dollar level) free of CGT. In recognition of the fact that no Town resident would personally own Town property, legislative relief would be granted to disregard capital gains on sale of Town shares, perhaps limited to a dollar level comparable with that on a tax-free principal residence.

The size of an individual's shareholding would determine the amount of lease payments; higher holdings would eliminate lease payments altogether, or even yield a net return – equivalent to property investment.

Rates, maintenance and depreciation would be dependant on the house or unit.

The arrangement of leasing means that movement is much easier, whether for up or down sizing related to changes in family size, or to achieve a better match to income. Relocation would be entirely tax free.

Individuals could not embark on the sort of spot development or extension that is so prevalent today, with all its inherent disruption both to the family and to neighbours. If the house they are in is no longer suitable, they would simply move to a different one.

When an area is finally deemed to have reached its use-by date, the whole area would be redeveloped after residents have transferred to other accommodation. Prior to then, individual property maintenance would just ensure the property is liveable for about the length of time to reach the area's use-by date.

Roads

The Town's road surfaces need be no more than 5 metres wide, with paint marks indicating the centre line, and further dividing each half into two, the outer for walkers and the inner for those cycling or skating. Direction and purpose (walk or cycle) could be marked on each section at intervals. The road strength needs to be sufficient for the very occasional truck, two of which could just slowly pass each other.

On-road parking would not be allowed, though brief waiting would be appropriate for the toilet hopper exchange truck, a car or taxi picking up a family with much luggage going far from The Town, or a disabled person. A stay of several hours, for example by a removals van or a garden or house maintenance truck, would be acceptable given notice of the possible disruption. Walkers and cyclists could still pass easily and trucks could just get by.

Cars would normally not be seen on these roads. Other powered vehicles, other than small electric motors on cycles, would also be rare. Faster road users would need to understand and accept that the safety of pedestrians, particularly children, the aged or disabled, would always take priority, thus ensuring that the entire road system is a safe place. *Mum's taxi* would be history; suitable older children could be entrusted to walk their junior siblings or friends to school.

We desperately need a way of life that no longer exacts a sickening toll of road injuries and deaths, and stops us from believing we have to drive everywhere.

Swale drains

The areas immediately either side of the road would be grassed concave swale drains, probably with fruit trees to take up the storm water and produce some crops and shade. There would be no need for storm drains: the total road run off would be half that of a traditional road (~8+M) with pavements either side (~2x1M), and there would be no run off from houses, since roof water is saved and there are no drives.

Modular construction?

The road fabric might be traditional poured reinforced concrete, or it might be constructed from pre-stressed reinforced concrete modules, which could permit a road to be constructed in a very short time, with minimal environmental impact, and would allow for ease of repair (by module replacement) and for road removal (and module reuse) if an area is reassigned. A challenge would be creating a road surface sufficiently smooth at the module joins, particularly for small-wheeled vehicles (skates and scooters).

No under-road services

There would be no longitudinal under-road services whatsoever, thus roads are never disrupted for installing or maintaining any services. If there are to be any underground mains supplies at all (electrical, communications) they would run lengthwise in a conduit in the swale area directly abutting the house lots, possibly covered in paving slabs, rather than buried, for speed of access and low cost of work. Connections crossing under the road would be permitted in order to service lots on the other side, but would preferably be created in advance of laying the road surface and would use sufficiently wide ducts that would allow for maintenance work on the cables without any road work at all. It might even be cheaper simply to run two parallel service ducts, one in each swale on either side.

Junctions

Road junctions would be either T junctions, all-way stop crossroads, or roundabouts, thus completely passive, requiring no signage or lights. All road users would be taught that priority is given to the horizontal on a T, to those already on a roundabout, or to prior arrivals at an all-way stop crossroads. There should thus be no need at all for any signage, road surveillance or traffic control systems.

Street lighting

A Town might choose to omit street lighting altogether. All vehicles down to and including cycles should have lights anyway, and it would be wise for all other road users (walking, skating, scooting) to wear a walker's LED headlight, front white, red rear, perhaps built into a hat! Omitting street lighting offers substantial financial and environmental savings, is one less eyesore, traffic obstacle and maintenance cost.

If there is an electrical mains network, relatively conventional street lighting could be an option, though for power saving, the lights should be LEDs.

If there is no electrical mains network, lights could be powered by separate PV panels and batteries. In that case, or even on mains, it might be useful to save power by using proximity detection devices, so that street lights only come on when human movement is detected in the area.

Absence of street lights would allow gazing at the night sky to wonder at the immensity of the universe.

Work

Nature of work in The Town

There would never be a shortage of some sort of paid or volunteer work; challenges include ensuring it is:

- productive, and appropriate to each person's skills
- safe and healthy, both for staff and customers of products and services
- sustainable, and environmentally and socially responsible
- as rewarding as possible, both personally and financially
- enough of it contributes to making The Town's balance of payments neutral or positive

Agriculture

The Town should aim to grow as much of its food, fibre, and wood as possible, hoping for few imports after a considerable period of establishment, and eventually exporting little if anything from its lands, since to do so involves losing some of its soil nutrients, particularly phosphate and trace elements, unless there are also food imports yielding comparable amounts.

The forestry area would eventually provide timber for the next generation of houses, and for local furniture making. However, on establishment of The Town, there would likely be no timber available, so it would have to be imported. It would be appropriate for one of The Town's initial industries to be the prefabrication of housing modules, leading to an export business for the sister and subsequent Towns.

On the outside of the agricultural area should be an extensive land area devoted to the country's wildlife. Such areas in each Town would link up to form transcontinental wildlife corridors. These areas would benefit from a certain amount of regular management, for example to reduce feral animal and weed populations, and also in appropriate countries to attempt to minimise wild fires by cool season burning.

In a world where mobile fuels are almost certain to become severely restricted, one of the key attributes of The Town is that the domestic area would be almost at a walking distance from the food lands, and thus, in emergency, access to food is no longer dependent at all on powered transport. Likewise, using phosphate-rich organic wastes from toilets and kitchens is simplified by proximity of houses to farm land.

Who knows whether in a few centuries we will be back to using horses? There is of course a trade-off, since producing their biofuel (oats!) takes up land that could be growing food for people. The impending lack of mobile fuels may mean that agricultural work has to become more manual, and thus demand more workers. Broad-acre farming (such as growing cereals) would need to move towards no-till farming, both to save fuel and improve the soil by not ploughing. There would similarly need to be more permaculture.

It is probable that raising animals for meat and dairy products would be considerably reduced compared to today's farming. Some residents would be vegetarian, but most omnivores would be aware that the food value from livestock can be down to as low as one tenth that of the plant food fed to the animals, and that ruminants (cattle, sheep, goats, deer, camels) generate large quantities of methane (mostly from the front end, contrary to popular misunderstanding!). Conversely, kangaroos methane output is minimal. Methane is a much more potent greenhouse gas than carbon dioxide.

There is, however, human or machine work to be avoided by smart use of animals. Confining hens and ducks to an area recently harvested and soon to be sown with other vegetables, results in delicious eggs, excellent poultry meat, and a virtually weed and pest free crumbly seed bed. Similarly, if an area that has been used for root crops such as potatoes or Jerusalem artichokes, which are not always easy to harvest 100%, then roaming pigs onto that land will ensure it is turned over and better cleared, with a pork bonus! Feeding grain to cattle would be inappropriate, and is a poor conversion of (normally oil-harvested) plant food to meat, and typically results in popular and expensive but overly fatty meat, such as marbled beef.

We have to recognise that however much many of us like to eat meat, it is not essential to our diet, or at least not in the quantities we consume today. There are health challenges with a *vegan (*purely vegetable) diet as it may lack certain nutrients such as vitamin B_{12}, though mushrooms are a useful source. This deficiency can also be made up by a diet of plant foods plus dairy – milk, cheese, eggs - but such a diet does not satisfy those who do not eat any part of animals from ethical rather than dietary considerations. This is because producing those foods with appear not to involve the taking of animal life actually do so. When chickens or ducks hatch, males are obviously of no value for egg production, so are either killed immediately after sexing, or are raised as poultry meat. For a cow to give milk, it has to have a calf first, and every year thereafter. Male calves are only of meat value, as also is the cow once it is too old to milk.

There should probably be only enough cattle to provide milk, with meat (and leather?) as by-products, and only enough sheep to provide wool, with mutton as a by-product. Older sheep meat (mutton) needs more cooking than lamb, and has virtually dropped out of availability these days in preference to lamb. Perhaps meat consumption, at least from The Town's own lands, should be ancillary to other products. There is however in Australia a substantial opportunity to improve the country, and at the same time eat meat, by harvesting some of the millions of feral rabbits, camels, pigs, and water buffalo. Their culling, transport and refrigeration are challenging though, and would consume mobile fuels.

One nutritional benefit of meat is that it presents the essential amino acids (those which our bodies cannot make from plant foods) in almost exactly the correct proportions to make our own proteins. We are, after all, meat! However, it was noted in 1971 by Frances Moore Lappé in Diet for a Small Planet that whilst both rice and soy beans are deficient in some of those amino acids, the excesses of the one counteract the deficiencies of the other, and if combined together at the same meal in the correct amounts, the intake is nutritionally almost identical to meat, but sadly without its texture or flavour! The high water usage for growing rice may be unattractive to a Town in some areas, so that might have to be an import.

Whilst continued use of significant farm machinery would be desirable, there are intermediate technologies available that significantly ease any manual work. For example, various companies in the past have produced human-powered wheeled tools (such as the Jalo range of hoes, rakes and seeders) that make modest human effort much more productive than if only simpler hand tools were used. Such tools could easily be made in a small workshop or foundry. Indeed, that might be a Town export opportunity.

Some areas might be used for fish farming. This can be an economical way of converting plant food to protein, since unlike land animals, fish are cold-bloodied and supported against gravity by water, not muscles, so use up next to no calories staying warm and upright, and only tiny quantities to move around.

Bee-keeping (apiculture) must be practised. In addition to providing honey and bees wax (for furniture polishing), the bees are essential to pollinate many flowering crops. Around the world, millions of Bees have been dying, a disaster for food production. There now seems to be sufficient evidence to link this to the use of neonicotinoid pesticides, which would not be countenanced in The Town, so its bees should be permanently sited there, not used for pollinating elsewhere if such chemicals may be in use.

Commerce

Residents will need to be able to do nearly all their shopping locally. One seemingly obvious option is to invite various national chains to set up in The Town, but that would probably be unacceptable in several ways, both to the chains and The Town.

To develop a totally sustainable way of life will demand a lot of effort and self discipline by all who live and work in The Town, and a policy of ensuring that as much finance as possible never leaves it. The nature of the products ranged by Town shops, and many other aspects such as packaging, availability of spares, ease of maintenance and eventual dismantling for total recycling, may well mean that outside companies would be unable to commit to The Town's conditions for running retail shopping, and would only set up if they could expect to export profits to their distant shareholders. It may be important, particularly for the prototype Town, for there to be privileged and private recording and reporting of commodities purchased and amounts spent in the shops. That may well require that all checkouts are run from The Town's data centre rather than the distant chains data centres. That would be an anathema to the chains. In any case, the products that they would find themselves ranging might be such a small subset of their usual business that they would not want to bother. I find nearly everything in today's supermarkets of no interest. Residents dedicated to a totally sustainable lifestyle might agree. In fact, analysing the outlets in a nearby shopping mall, I find nearly all its *shops* of no interest at all.

Also, with a strong policy of getting end users to lease rather than buy most household and vehicle equipment, there would be little point in trying to retail a range of goods, such as electrical kitchenware and white goods, and there would be no reward at all in running a car sales room or a real estate agency.

There should be substantial and well-organised second-hand retailing, appropriately located next to the R&R Centre! Reuse of all still-good items can make significant savings to the wallet and environment.

Providing banking could be a challenge. The Australian banking scene has for years revolved mainly around four large banks, quite similar in their capitalisation, with some smaller operations alongside. These big four have had a poor reputation in the past for pulling branches out of smaller towns. Where such a branch closed and it was the only bank in town, and where there was no sub post office providing some banking facilities, that town's residents and retail sector were left in a difficult financial situation. So it seems unlikely that any of the big four should be invited to run banking in The Town. In any case, it would seem wise to start off the retailing sector in a brand new Town on a primarily cashless basis. Thus most residents and visitors would pay electronically for most purchases, retaining cash payment as a deprecated option for any who choose not to use such systems, and for minor purchases.

Light industry

The most appropriate light industries would fabricate items or provide services needed in Towns:

- Prefabricated housing modules. Obviously, this should be an industry established at the start of The Town's construction. Once its own needs are fulfilled, the work could switch to making modules first for the sister Town, then for subsequent Towns further away (but as local as possible to minimise transport costs), then to repair work on existing stock, and much later, beginning to replace the original housing stock as it reaches end of life. Initial materials would almost certainly have to be imported, but after a few decades, local timber should be available, at which time timber milling and and fabricating composites would be required
- Producing and maintaining small agricultural machinery. As oil availability fades, it is probable that agriculture will need technology that is higher than pure hand tools, but lower than the complex (and heavily soil-compacting!) equipment prevalent today. There might be an export market both to other Towns, and to small holders, both in the country and to developing nations
- Vehicle repair. There would be enough vehicles, domestic, commercial, and agricultural, to justify at least one vehicle repair shop, which occasionally could also be helpful to passing traffic
- Cycle (and associated items) construction and repair. There would be a high proportion of bicycles per person in The Town. Related items might be: adult tricycles, covered large tricycles operating as rickshaws for self-drive lease or taxi-like hire, tow bar attachments such as kiddy carriers and shopping trolleys. The trolleys would be unlike those used solely by pedestrians in supermarkets but would double as that. They can be unhitched after parking the cycle, taken first to the R&R Centre to dispose of unwanted items and recycling, then round the shops, and finally re-hitched to the cycle for the homeward run. They might be Town-owned, not personal property
- Domestic equipment maintenance and re-manufacturing (refitting still-good refurbished carcases – such as washing machines - with new active components)
- 3D printing of small to medium components, particularly for equipment maintenance

Education

Education as a service was briefly introduced earlier, as it is a key activity when determining a good size for The Town. It is one of the most important issues in the minds of many people: parents, grandparents, employers, politicians, even citizens with no descendants but who are well aware that their own good life deeply depends on living in a well-educated society.

As explained earlier, given a population of 15,000, there would be some 2,600 pupils (~130 classes at 20 per class) in kindergarten to year 12. These might need about 160 teachers. Children's education should begin soon after birth, so there could be a cohort of ~1,000 in the preschool range, for which the teacher to pupil ratio need to be much higher (average 1:10?), so there might be ~100 preschool jobs. Some parents need day care for their children from a very early age. Others will want them in preschool for a few days a week for social as well as educational reasons. Locating pre-schools next to years K-4 primary schools would be good. Preschools would also need administrators and maintenance staff.

The presence across the highway of a sister Town would substantially increase the educational career opportunities and the subject range possibilities. It would also enable sporting and other competitions.

In addition to schooling up to year 12, there could be adjunct departments of distant universities, particularly those studying the physical and social aspects of The Town itself. Thus some students born and raised in The Town could continue on to at least some university courses without leaving The Town. Distance learning is now well established, so it would be quite likely for some of its practitioners (teachers, writers, and tutors) to live and work in The Town, electronically exporting their services.

Health

Health is another key activity in determining the size of The Town.

Again, as explained earlier, given a population of 15,000, there could be sufficient work to justify 30-45 doctors (including specialists) plus nurses, optometrists and opticians, pharmacists, physiotherapists, dentists and others. The numeric opportunities would be roughly doubled if there is a sister Town, but the career benefits would be higher still, if some medical specialities become viable at ~30,000. High band width communications and digital X-rays might make it unnecessary to have radiologists on site, though some radiologists might want to live in The Town, whilst also working remotely for others.

Hospital

The Town together with a sister Town would reasonably justify a medium-sized hospital. Australia's 23M citizens are served by about 750 public hospitals so 30,000 is about the average.

Births, marriages and deaths

Maternity services: A birth rate of about 200 per year should justify a small maternity unit, as a part of the hospital. One report on small UK maternity units suggests that perhaps only 2-3 beds would be pencilled in as maternity beds, per Town, or 5-6 beds if the one maternity unit serves both The Town and its sister. The bed provisioning assumes an occupancy of 2-3 days per birth, which is common nowadays.

Marriage services: At current rates (~5.5/1000/year), there might be about 1-2 weddings per week in The Town. In addition to the provision of civil and religious celebrants (clearly part-time), it would be valuable to have marriage counselling services, not least for those contemplating their wedding. Counsellor and celebrant could easily be two roles for the same person. Being, or more importantly staying, married is not particularly easy or obvious, as the divorce rate testifies. We expect to receive training for most careers, which will presumably take up about 25-30% of our lives. How much more so might we value some guidance about this major activity, before and after the wedding. Some of the foregoing could valuably be offered also to those choosing to partner without a wedding.

Funeral services: If there are about 200 births per year in The Town, it seems likely that there would eventually be about the same number of deaths per year. Initially, that might be lower, as the prototype might attract a younger demographic, though it might be wise to try and select cohorts that mirror the average country age ranges once most of The Town is up and running, particularly its accommodation.

Cremation (acceptable to most religions except Islam) or burial in the ground are the most obvious methods of disposing of mortal remains. Cremation uses a lot of fuel, and since nobody in The Town would want to be using a fossil fuel, it would have to be timber, almost as unacceptable given its better uses and the emissions from burning it. Perhaps it is time for burial to re-emerge as a favoured approach, but in a shroud or a cardboard coffin. After time, the land can be reused for later burials. A centuries-old tradition is that a spouse is buried on top of the pre-deceased partner. Eventually that land might be returned to an agricultural function, perhaps as forestry or orchard so the land will remain undisturbed. This is not the happiest of subjects, but having lived lightly on the earth, we also should leave lightly.

Building

We simply cannot continue indefinitely to build in concrete, brick, steel, and vast amounts of glass. Modern city and suburban buildings all demand large amounts of non-renewables, which are not even partly reused upon demolition. The materials may often be 'recycled' but in fact that should read 'decycled', that is, turned to a use (usually inferior) other than the original purpose.

For example, reinforced concrete is first crushed (substantial energy needed). The steel is magnetically extracted and remelted (more energy), and perhaps is of sufficient quality to be recycled into new reinforcement rods, but the concrete would have to be used for road base or the like, which is fine if new roads are required. That may not happen as mobile fuels disappear and The Town's philosophy succeeds.

So natural building materials, particularly timber (or composites) would seem to be the main way forward, together with a few other grown products, as well as materials that can be won from the earth, but used in a way that makes them reusable indefinitely, such as sun-baked adobe or rammed earth bricks.

[Typically, adobe bricks are made from sand, clay, water and some fibrous material, sun dried, then protected from rain erosion by roofing and wall coverings. If an adobe building is demolished, the bricks might be reusable as such, or their materials can be re-wetted and used to remake bricks indefinitely.]

To as great an extent as is practical, it would be good for most buildings to be prefabricated. The word “prefab” has a 'cheap and small' connotation to some, primarily from immediately post World War II history in Britain, but some modern prefabrication is to a very high standard, such as Huf House. Making building modules in a factory provides excellent conditions (unaffected by weather) for workers, the quality of the products, and for careful materials control, with opportunities for minimising wastage and ensuring that any totally unwanted off-cuts are collected carefully for recycling. Compare that with the typical mess on a traditional building site. It also offers a very short on-site construction time.
Some non-renewable building materials are indispensable and have no renewable alternatives. Sheet glass is a prime example. These days it would always be made by the float glass process, in which molten glass is poured onto one end of a bath of molten tin. It would be valuable to standardise on window sizes, so that upon careful demolition, windows - or at least their glass sheets - could be reused. Broken glass that has been kept clean (cullet) is recyclable by remelting. A proportion of cullet in a melt is desirable, since it melts more easily than the raw glass source materials, which happily are plentiful.

Another material that is non-renewable, but potentially reusable (or recyclable) is steel as foundations. These components are variously referred to as earth screws, ground screws and screw piles. Threaded piece of steel are screwed into the ground and provide a firm attachment for the floor beams on which the rest of the house is built. Use of them avoids the traditional concrete slab and/or footings, which are more expensive to install, consume non-renewables, are virtually non-recyclable, and are difficult to remove if an area is reassigned from housing, for example, to open space.

Equipment

Manufacturing most equipment would be beyond the scope of a Town by itself, so it would have to be imported. So where should such goods be made in a country which had eventually restructured around Towns? Economic production requires considerable volume of manufacture, or at least, final assembly. The Town could well take part in component manufacture. Increasingly, a question is whether a particular *country* shall make certain goods. For example, at the time of writing, Australia expects to lose its last major car assembly plants shortly after the middle of the 2010 decade, with potentially devastating results to the surrounding associated component manufacturers. Of course, as oil becomes scarcer, making something far away and exporting it thousands of kilometres will become harder, thus bringing that dis-economy of scale into play to counteract the manufacturing economy of scale.

Bear in mind that the volumes of manufacturing *must* decline. The era of making goods relatively cheaply but at a quality that is certain to last only a few years *has to* pass. Goods must last far far longer than now. That might make the price a lot higher, but the price per year of use could become significantly lower, and at the end of a long life 'as new' the items should be refurbished, putting new components into old but still perfectly good chassis. It is likely that very lengthy life of goods will only come about by legislation on mandatory guarantee periods, though some manufacturers do seem already to be lengthening these times as a product benefit and therefore sales promotion.

The scale of major manufacturing may well be outside the scope of a Town, so perhaps there should be factory complexes located on highways near enough Towns to permit easy commuting from several of them, thus also diluting the unemployment problems if a manufacturer should fail.

Equipment needed or desired in The Town would not differ markedly from elsewhere, though quality, life expectancy, and local repairability would be carefully considered by the purchasers:

Domestic

White goods: refrigerators/freezers, clothes and dish washers
Electronics: HiFi, computers of all sorts, networking, mobile devices
Kitchenware: Mixers, toasters, food processors
Homewares: Hot water systems (thermal panels, heat pumps), solar PV panels and controllers

Vehicles

Cars, Trucks, Agricultural
Leasing – a Town company for return to Town hires/long term leases
Leasing - national companies for one way hires

Acquisition

Insistence on manufacturers' standards
Reuse/recycle capability
Availability of spares
Maintenance manuals online

Equipment and fleet maintenance skills

Electricity, electronics, plumbing, automotive, agricultural

Tourism and leisure

Transit and visiting accommodation

Some suitably sited Towns would be well placed to offer accommodation to travellers, either because the location is a convenient half-way stop over on a long journey, or because there is some nearby tourist attraction. Such facilities would be built at the interface, for ease of access from the highway. They would offer *almost* conventional motel or hotel style arrangements (such as parking next to rooms), but with obvious variations to suit The Town's philosophy, not least composting toilets! The layout of the motels might borrow somewhat from the hostel approach, with shared kitchen and dining facilities.

All Towns should find a demand for visitor accommodation for people coming to see resident friends and relatives, sometimes in groups for events such as weddings. Other visitors, particularly in early prototype Towns, might have no present connection with The Town but desire to experience its way of life, perhaps with a view to becoming residents in such a Town.

Some of the travellers' accommodation could start life as housing for those working to construct The Town, either because they do not plan to stay in the completed Town, or as their house is not yet ready.

Variations from today's work

There would be some trades and professions which would be required more plentifully in The Town than in today's conventional society, and others which would have no place there or would be present in a far more limited way. Some would see the missing roles as a drawback (“lack of jobs”), but every function rendered obsolete by the nature of The Town is really one more argument in its favour, particularly where the work is fundamentally non-productive or even detrimental. About every occupation we should ask (echoing Kennedy) not just “what does this do for my wallet and family” but “what does this job add to the community” (“Ask not what your country can do for you, ask what you can do for your country.")

Additions

Agricultural work will demand more human effort to replace the gradual loss of mechanical tools. This is inevitable, given the likely soaring cost of oil and the need to cease burning it anyway.

Reuse and recycling would be a major activity, closely involving everyone, to a far greater extent than today's (valuable) efforts in putting unwanted materials in the correct bin. In addition to those staffing the reuse and recycling centre (hopefully partly volunteers regularly rostered on from all parts of the community), every resident would be keen to ensure at the point of purchase that items acquired were either able to be reused by others once they no longer want them, or could easily be 100% recycled.

Subtractions

Estate agents and related functions would have no place, since there would be no personal real estate ownership. Selling a property to fund moving into The Town, or buying a property on moving out, would be facilitated by an external agent. There might be a solicitor in The Town for other functions, but there would be so little call for conveyancing that it could be left to an external solicitor or conveyancing firm.

Building developers as such would find no opportunities, though there would be roles for most of the related trades, since there would probably be continued development of the commercial and light industrial areas, and eventually a rolling complete replacement of the domestic accommodation.

Tobacco is most unlikely to be grown or processed. Smoking should be actively discouraged, not least by the simple step of having no relevant products on sale anywhere in the retail area. Whilst smoking is

now prohibited in many places, it may take decades before it is totally banned from society, so there should be no obstacle to bringing legal tobacco products into The Town for personal consumption. The USA's lesson is to be remembered: alcohol prohibition produced exactly the opposite of the desired result.

Management of traffic and public transport would be almost entirely unnecessary, given the almost total absence of either. There would be occasional tasks such as ensuring anybody driving within the domestic area had good cause and was fully aware of the special rules, such as vehicles take the lowest priority.

The absence of water mains, foul sewers, and storm drains would eliminate many tasks that are absolutely essential in conventional society, but have been deliberately designed out of The Town.

The car-free nature of The Town would massively reduce the need for road accident trauma medical skills and facilities, though such services would sadly continue to be needed in the event of highway tragedies.

There are activities that take place legally in Australia, as elsewhere, that probably should never be banned (forbidden fruit are the most appealing) but are a total waste of time, money and resources. An obvious example is gambling. I would think it appropriate for there to be a pub or club in The Town, but certainly not with any poker machines. Before long, add motor racing – what's the point when the oil is both running short and should no longer be burnt? Anyway, no suitable roads!

Finances

Creation of the prototype.

Some of the cost would be determined by the available land's price and location. Those are likely to be in an inverse ratio: the cheaper the land, the further it may be from resources needed for the build. An objective is that when - after several decades - a certain amount of rebuilding becomes necessary, The Town shall have the materials (principally timber), the skills and the facilities to perform the work locally.

However, the housing and working places initially provided in The Town would be an alternative to similar constructions elsewhere, typically in cities. The chief difference is that the latter buildings are nearly always infill placements financed privately, whereas it is very hard to imagine that The Town, at least the prototype, could be built other than with substantial or total government or philanthropic funding. The cost would be in the billions, but the total unit cost would be dramatically less than the *real* cost within an existing city. Frequently, the infill private costs do not reflect the real costs, as the new building relies mostly on existing publicly-funded infrastructure, which will later be enhanced at public expense if it proves inadequate following the development.

Just as a back-of-the-envelope example, if it currently costs perhaps ~$300,000 to put up a modest house, if the land for The Town is much cheaper than city land, the domestic accommodation might need ~$2.5B

Australia's population is about 23M, at an occupancy of ~2.5 per dwelling, of which there are therefore about 9M. Taking a wildly optimistic average house life expectancy of 100 years, there might need to be nearly 90,000 domestic building replacements per year, equivalent to some 15 Towns, except that building *replacement* in a city would be substantially more expensive (demolition and more difficult access) than initial building *creation* in The Town.

So every year, vastly more money is being spent on work similar to that needed to construct a prototype Town. It is (just!) a matter of diverting a fraction of it to create The Town.

Balance of payments

The Town should run its governance and finances as a separately governed entity from the locality, and

just as a national government needs to attend to the country's balance of payments, survival of The Town requires it to ensure its overall income is at least equal to its expenditure.

Taxes

Governments, both state and national, would no doubt continue to levy taxes on Town residents and businesses. It would be helpful if there could be at least as much government money spent within The Town as the level of taxation imposed.

A government should find it would need to spend a lot less on The Town than on a similarly sized grouping, or else the whole exercise is a failure. The key point of The Town is to reduce conventional financial and environmental expenditure on services such as roads, the three water services (mains, storm drains, sewers), health (a car-free and therefore much fitter community) and in many many other ways.

It should therefore seek to reduce the effect of taxation hopefully by restoring, through government spending, as much money as it extracts as taxes, most notably on education and health services, but also by remote employment (such as telephone help services) in government institutions.

The city/country tax/spend imbalance is perhaps one of the major drivers towards depopulation outside major towns and cities, and partly responsible for a “them and us” mentality on the part of rural citizens.

Clearly The Town would be subject to many of the laws and economic realities of its host country, but it should also enjoy some additional benefits, and relief from some aspects of the country's government and laws. If a social experiment on the immense scale of prototyping The Town were to be constrained by every jot and tittle of existing law, it is unlikely to be a successful new model way of life.

For example, in Australia, a person's principal residence is not normally subject to capital gains tax (CGT) upon sale. If, in The Town, there is no direct personal property ownership but instead people own Town shares, then there would be a considerable disincentive to sell up outside and transfer into The Town unless sale of those shares was exempt from CGT, perhaps up to a limit comparable with property values.

It could be open to governments to swap certain financing responsibilities. For example, taxes could be reduced if some normally government-funded roles such as public school teachers became Town-funded.

And unlike a standard local government council, The Town needs to be aware, at a general level, of the total money flow, not just its rates income and expenditure. It is therefore quite possible that would entail residents and businesses giving up some of the expected norms of privacy. For example, it would be quite unacceptable to deny people the freedom to purchase various items from anywhere they chose, but it might be most valuable to be immediately aware when they are going to outside suppliers. Sometimes they would have no choice, as there is no in-Town supplier for a particular service or commodity, but in cases where that is not so, it would be useful to ascertain reasons, in order to improve in-Town offerings.

This would be highly contentious. In conventional society, most people would react with “It's my money and I'll spend it how I like and in privacy thanks very much!” In fact, most of us spend most of our money in a constrained way, out of our control, on all the necessities, with not too much left over for discretionary purchases.

If individual income and expenditure were to be available, it would probably have to be to a special unit within The Town, charged with monitoring that data, quite possibly in summary rather than fine detail, but with strict rules about not sharing the raw data at all. There is a comparable situation: we legislate to allow governments to perform a detailed census on us in order to carry out informed planning. The data gathered is highly personal, but before publication is then summarised over a sufficiently large enough

sample (for example by area or numbers of people) such that individual information is not disclosed.

Insurance

The Town should probably self-insure its buildings up to a certain value, as is the usual policy for many companies, which simply accrue some funds in their own accounts instead of paying premiums and claiming back. It is however vital to insure externally against an overwhelming disaster.

Real estate values

The world may have to prepare itself for a massive shift in real estate values if sea levels rise by 60M. Big cities and all their suburbs are currently worth uncountable trillions. If they finish up below sea level, they will become worthless, and there is nothing a government can do to alleviate that financial impact.

It will be a bit like a slow motion hurricane. Your choices will be evacuate or drown. The difference is that you might be able to return after a hurricane and find your house still liveable. With sea level rise, it would probably take thousands of years before ice will reform and drop the levels again, if ever. There would be a lot less land for humanity to occupy. In Bangladesh, there could be none; all her 150M people would lose most of their 150,000 sq km. Even a 1M rise would inundate 10% of that country. Australia would fare better, though coastal cities and suburbs would be lost, and the Eyre basin might flood.

Governance

Ownership

The Town should be a company owned by its share holders, and every adult individual resident is required to own at least one share. The Town permanently owns the freehold of all the lands, and is not subject to any land taxation thereon.

Shares would not normally be owned by non-residents or companies. Exceptions would include Town-focussed superannuation groups, and prospective residents who have not yet moved in, or former residents who have moved out and not yet sold their shares, or who have died. There might be time limits on non-resident share ownership and restrictions on inheritance.

Shares should provide a return, which normally is offset against leasing, maintenance and rates costs. Any surplus is an income to the shareholder. Such a surplus would arise once a shareholder had more than sufficient shares to pay those costs. The money would come from those paying leasing costs on account of having insufficient shares. Only such surplus income should be subject to income tax.

Leasing a particular property would be arranged though a leasing department, operating transparently on a set of guidelines about entitlement and priority, together with algorithms to ensure that nobody is on a queue indefinitely.

Thus obtaining a first lease of a very modest property for young people, and up or down sizing as family needs change, becomes much easier, and free of massive financial commitment and transactions.

Government

Council

The Town's government should be controlled by an elected council, which should be granted local government status for the area. Any nearby standard council should have no jurisdiction in The Town, since that council would be operating under the existing standard local government rules whereas The Town is running under special Town prototype or subsequent legislation.

The Town council should be elected by all resident adults, though perhaps the age at which 'adult' is determined for this purpose might be a little reduced. This is an era in which responsibility for civic affairs could valuably be granted to those in, say, school years 11-12. Candidates must be residents. The election should be controlled in the standard way for local government.

Share holders

The Town would be owned by a company that is owned by its shareholders. Normally that would lead to the election of a board of directors to run the company. Would such a structure be superfluous, given that the shareholder population is almost exactly a subset of the resident population who elect the council? The difference is that residence confers one vote for council but each share confers one vote for the board.

Enabling legislation

It is probably inconceivable that a prototype of The Town could be created entirely within the existing legislative framework. That issue has to be tackled. It would look pretty stupid to our descendants if we left them a wrecked world “because an alternative structure was not compatible with the laws of the day”.

Law reform often drags reluctantly behind practice, sometimes with dire consequences for those who choose to ignore existing and out of date legislation, as exampled by the suffragette movement to obtain the vote for women. Sometimes it leads. Obvious past UK examples include banning slavery, or insisting on proper ship lading (the Plimsoll line).

In a federated country like Australia, it is almost certain that lead legislation would be required in the federal parliament, and would include template legislation that would need to be passed by each state.

If I were a betting man, I would expect that this is the area where The Town is quite likely to fail, because our overall legislative systems (and not just in Australia) are so cumbersome and lethargic that we *are* indeed going to look stupid to our descendants. That's sad, because I foresee a time when the looming and inevitable resource crisis begins to bite so hard that a semi-dictatorial warlike-footing government results. As is common during such times, peoplen reluctantly accept rough and somewhat arbitrary direction through the oft repeated “Don't you know there's a war on?”

We can and must do better. The sooner we start to plan for and trial a future in which we follow The Rules of living indefinitely on a finite planet, the better will be the resulting structure of that new society.

Zoning and development applications

Areas in The Town could be zoned as commercial, light industrial, domestic, food and annual or animal fibre, forestry, and wilderness.

Rezoning proposals and development applications might be controversial, but they would rarely offer any possibility of corruption, since very few involved would have any opportunity of personal gain, given that land is and always stays fully owned by The Town, and thus by the residents collectively, through shares.

With conventional local government and land ownership, suspicions (though not necessarily occurrences) of corruption are possible when private land is rezoned or development applications are granted where the result gives a substantial and unearned financial benefit to the owner. Conflicts of interest arise when the applicant is a councillor, either in their private capacity as a land owner, or because of a business interests. Proposals have been made in the past to exclude real estate agents, conveyancing solicitors, builders and developers from being councillors. No such prohibitions would be needed in a Town where all land is owned by The Town and where consequently none of those occupations listed are practised.

Most development applications would come from one department of the council to be presented to full council for debate. Since there is little or no possibility of a need for application confidentiality (“commercial in confidence”), any professional involved in design work would need to agree that all

aspects of any designs would be made publicly and electronically available.

Policing

It would be nice, but unwise, to imagine that the society in The Town would be so agreeable, and sufficiently free of any drivers towards hooliganism and criminality, that policing would be unnecessary, but hopefully The Town would need far less than the Australian average of about 2 police per 1000.

Police get involved in too many activities that one might think should be the responsibility of other professionals. Often they have to handle issues related more to excessive use of alcohol, or individuals with mental health issues, and dysfunctional families, rather than outright criminality. Individuals drug and drug-related issues should be regarded as more akin to health problems than crimes. Issues include:

- Should police be from out of The Town, thus somewhat removed from conflicts of interest? If there were to be a sister Town, it could be economical for each Town to house the other's police
- Should The Town be running operations which, without conflicting with law, take over some of police activities, such as care of drunks or disturbed individuals

Police would be responsible for ensuring proper use of the shared domestic road system.

Risks

The Town would be subjected to most of the risks we experience in our current society. Some of those risks would be amplified, others abated.

Insurance

Town residents would typically not need to carry much, if any, insurance on belongings as they would be leasing accommodation, kitchen and laundry equipment, and maybe a vehicle, so the lessor would be responsible for its insurance. Incidentally, the lessor would also take care of such activities as: recording the age of items for ensuring guarantees can be taken up in the event of claimable failures; having annual vehicle inspections performed and compulsory third party insurance acquired; and so on. Thus residents lives are considerably simplified, and annual expenditure spikes eliminated.

The Town would probably carry most of its own insurance, providing cover for individual events up to say a million dollars, such as single house fires. Self insuring is standard within large companies. Instead of paying out premiums to an insurance company, they accrue sums of money instead, and spend those if an insurance event arises. What would be essential is to take out an external policy covering disaster insurance, such as major devastation from fire, flood, or storm damage.

Residents might well wish to take out life insurance, which is sometimes associated with saving schemes. Since those schemes are in essence investment instruments, it might be desirable for them to be provided by companies which invest in Towns across the country. It is unwise for such activities to be too closely associated with *their* Town, since a financial disaster hitting that Town could devastate many of its residents' policies as well. That is the same approach as not investing the pension funds of workers in their employer's company, since its bankruptcy doubly attacks the workers future.

It is also appropriate to have better control over superannuation funds, since otherwise those funds could be invested in activities which are an anathema to the philosophy of The Town, such as fossil fuel and nuclear interests, armaments production and so on.

Food security

This is one area where The Town should be more secure than most. As oil prices rise, so too will the cost

of food to most people, as growing their food relies on the use of oil-based fertilisers and long distance transport. Most of the food for The Town is grown a few kilometres away from the houses, using soil-nurturing techniques such as permaculture, no-till farming, and returning all organic materials to the land. All those also help with another scourge of farming – drought. Constantly improving the organic content of the soil increases its moisture retention ability.

Water

Water risks include the quality, cost (if tankered in) and availability of the domestic supply, drought affecting gardens and agriculture, flooding, and soil salinity.

Most houses in today's developed societies have a connection to a water main, supplied by pumps and pipelines from a distant system of reservoirs and purification stations, backed where thought necessary by desalination plants. Houses in The Town rely instead on water from the roof, and if required, a delivery by tanker. Medium sized solar powered desalination plants are becoming available. If there is a local source of brackish water, such a plant might be valuable to provide tanker refills. Better still if there is a clean stream within The Town's lands that can properly be exploited as a water resource. The Town inherently uses far less water, thanks primarily to the composting rather than flush toilet, but also by low water usage devices (better tap and shower outlets) and (importantly) better habits of the residents.

Avoiding running out of water needs to be kept in mind at most times. Today, a shock comes when the quarterly water bill is huge compared with previous quarters. My bill from Sydney Water has a graph on the front showing average litres per day for: the current bill, last bill and “Same time last year”. One bill's figures were: 1042, 627, 322. A quick tour round the house did not reveal any nasty leaks. All I could assume was a hose had been left on at the end of the previous quarter continuing into the billing period. Subsequent daily reading of the water meter revealed no huge consumption.

So monitoring by quarterly bill is *hopelessly* inadequate. There needs to be a data feed from the house's water pump to the house's monitoring system, whether that be an in-house computer or a facility provided by The Town's data centre, via the network. And there need to be almost real time alarms, so that an unusually large and continuous flow rings alarm bells, literally. It would be unrealistic to monitor every water outlet, but drawing attention to the pump's excess output by an alarm system should be sufficient to alert the householder to an unusually large flow.

Water can be condensed or generated from humid air, perhaps using renewable electricity to chill the air, thus extracting some of its dissolved water, just like the drips from a car or in-window air conditioner.

Fire

Bush fires are often raging infernos that pass very quickly – maybe no more than a few minutes. It is just about possible to design houses which are passively totally resistant to them, but such a house would need to be made almost entirely with non-renewable materials.

Bush fires are a perennial feature of countries such as Australia. They can be mitigated by cool season controlled burning, which reduces the fuel load in a relatively safe way. They can be kept away to some extent from domestic areas by good house-and-garden care, such as not having substantial bushes and trees or long grass right up to the house, especially if it is mainly constructed of timber. To avoid ignition by flying embers, it is important to keep gutters free of leaves during the fire season, and preferably at all times by a gutter leaf guard, which also improves water collection.

Ample supplies of water must be on hand during times of greatest risk, together with the ability to pump it and distribute it easily and very quickly, especially to the roof, perhaps in the absence of electrical

power, though underground mains and battery storage reduce the probability of fire-caused electrical outages. Cylinders of high pressure nitrogen gas might be a way of powering a short deluge of water at a critical moment, but control of such an action probably requires the presence of a resident during the fire, the oft-debated “flee or stay and protect” dilemma.

Protection against domestic house fires would be standard, though the absence of any combustion (no gas, no solid fuel fires, and preferably no smoking) would reduce the chances of fire. Also, the complete lack of traffic jams on the roads, and the short distance from a fire station at the interface to any house would improve fire fighting. The fire engines could also serve the local area as well as within The Town.

Cold season fuel reduction burning may be all that can be done to protect wilderness areas. Forestry areas can be partially protected by fire breaks and by ensuring that all prunings are removed, for chipping and use as mulch. A total fire disaster is probably unavoidable to some Town, some where, some time, but that is why The Town should offload its disaster insurance to the market, preferably one run by all Towns.

Storm

Cyclones and hurricanes have the potential to wreck a Town, and there is probably nothing that an individual Town can do to stop that, short of building all structures using brick, and concrete for slabs and ceilings/*flat* roofs, with heavy steel shutters able to cover all windows and doors. Those who live in the USA's tornado alley would add that there must *still* be a storm cellar below the slab! Life in a bunker, but then there is next to nothing humans can do in the face of a huge tornado. And not everything can be well protected. Expect to emerge from the cellar to find such a house largely intact, but your car upside down in a tree, your farm animals dead and scattered across the land, and your barns ruined. Start again.

Such an approach might be appropriate there, but it is inimical to the concepts of living lightly on the land and avoiding using up non-renewables. The main strategy would probably be to make sure that Towns in a severe storm-prone area (and who knows where that might be as climate changes) have sufficient disaster insurance, and a few very secure buildings where residents can congregate till a storm passes.

Pests

Pests affect activities in several categories, particularly agriculture, buildings, and human health. This is not the place for a comprehensive dissertation on the subject, but it is important that the key rules are not breached in tackling these issues.

Agricultural

Monoculture, such as planting a wheat crop from here to the horizon, makes it very easy for the farmer to harvest, but also provides a feast for insects and an opportunity for viral and fungal infections to flourish. These attacks mean spraying with chemicals is almost always required, which can backfire if it harms beneficial insects as well as the target pests. Repeated travel over the farm land in massive tractors (to spray, and spread fertiliser) combine harvesters and produce collection trucks compacts the soil, making it harder for useful fauna such as worms to aerate the soil. The soil structure they have built up over months is then destroyed after the harvest if the land is then ploughed up and raked, ready for the next sowing.

One of the better defences for plants against pests is soil health. The land needs to be rich in organic matter, both to feed the plants and to retain moisture. Crops thus grown are healthy enough to resist much of the attacks. We also need to become less picky about produce quality and appearance. It is slightly disconcerting to find a small worm eating your apple, but at least it tells you that nothing died there!

Other defences are diversity and companion planting. If the area of a crop is small, its pests cannot spread so easily. Better still, plant another crop nearby that is repellent to the pest.

As mobile fuels become scarcer, and the realisation sinks in that massive land machines are spoiling the soil, we may well have to change the way we do agriculture, employing (as intelligently as possible) more human labour and less machinery. We may well also have to change our diets, particularly if broad-acre farming become less and less tenable, making cereals more expensive. It may be improved by no-till planting, which eliminates the damage to soil structure from ploughing and reduces that from compacting.

Buildings

The primary pests affecting buildings are fungal and insect attack on timber, woodworm on furniture, and clothes moths in the wardrobe. Rule #1 (do not use *up* non-renewables) and a desire to avoid toxic chemicals (particularly where ultimate disposal might affect a water table) would inhibit the traditional use of green chromated copper arsenate to protect timber against termite attack. Alternatives include the pyrethrins, which can be harvested from the seed cases of Chrysanthemum cinerariaefolium, and are widely used as insecticides. If timber is made into composites, such protective agents could be incorporated into the gluing and lamination process. Physical protection is also important. As houses are on earth screws, guards on the pillars should be used to block the invasion of insects from the ground, just as cones on docking ropes prevent rats boarding ships.

Human health

Avoiding or counteracting pest attacks against people in The Town would not be very different from now. Mosquito-borne diseases are likely to become more prevalent and more dangerous as the climate warms, so it would be good to work throughout The Town to deny mosquitoes any breeding place. Windows should be well fly-screened and mosquito nets should be used over beds.

Health

The Town would avoid a number of ways of catching diseases:

- No public transport, so no travelling alongside those who really ought to have stayed at home
- 'Visits' to the doctor do not start in a waiting room, where time is wasted and sicknesses shared
- More working at home than at present, so no disease sharing in an office
- Without disclosing individual patient data, there would be information on prevalent sicknesses
- Even shutting its borders in the event of an outbreak of a deadly and highly contagious disease

The life style in The Town would itself lead to a major improvement in the health of its residents. Humans evolved to stand, and move around on their feet. So what do many of us do most of the day? Sit in a bus or train, drive a car in stressful traffic, or sit at a desk. Too much food (often of the wrong sort) and not enough exercise is leading to a plague of obesity, diabetes and many other related conditions.

Crime

It would be wonderful if The Town could be crime-free, an excellent target but an unwise assumption, but many aspects of The Town would dramatically reduce the drivers towards criminal behaviour, and the opportunities. A New Zealand "drivers for crime" forum cited the main causes, noting "Many of these issues are concentrated within socially and economically disadvantaged families and communities”:

- Family dysfunction
- Child maltreatment
- Poor educational achievement
- Harmful drinking and drug use
- Poor mental health
- Severe behavioural problems among children and young people

- The intergenerational transmission of criminal behaviour

It is perhaps one of *the* key targets for The Town to ensure that it is a community both collectively and individually richer in real wealth than any society has ever been, not in material terms, since that it simply impossible on a finite planet, but in measures of health and welfare, learning, environment, beauty, caring, arts, medicine, and many more, but also in its negative scores for crime, violence, and in a larger context, military expenditure. Time, money, and other resources spent on tackling the above list of causes would be superb investments. During the forum, one judge said "80% of all offending in New Zealand occurred under the influence of alcohol and drugs".

Much of the crime resulting from over-indulgence in alcohol is violence. It would be essential that all those working at outlets retailing alcohol adhered strictly to a "responsible service of alcohol" policy. Conversely, drug-related crime is more often property theft. A society in which most people tend to lease rather than own many items would not offer much opportunity for selling stolen goods. Attempts to take them out of Town would be rather obvious, given the restrictions on use of vehicles within the domestic area. All goods would also be serialised and marked as the permanent property of the lessor company.

Social unrest

Social/political unrest is primarily a child of insecurity resulting from real or apparent threats to key aspects of life, for example (in no particular order of importance):

Aspect	**Threat**	**Town's preventative actions**
Food security	Hunger, starvation	Growing most of its own food
Accommodation	Homelessness	Never tolerated: active office to ensure nil
Personal and family safety	Violence (domestic or external)	Refuge available and counselling
Possessions	Crime	Fewer personal possessions; police presence
Environment	Pollution and degradation	Internal: never acceptable; external: vigorously opposed
Employment	Redundancy	Major local jobs program to counter any external redundancy
Solvency	Bankruptcy	Financial counselling and loan services
Meaningful existence	Boredom	Always opportunities to help self and those less well placed
Political empowerment	Sense of powerlessness	Total involvement sought from all on all Town policies

Most families would have a deep concern for the welfare of The Town as a whole, since their investment is in Town shares not real estate. Consequently, the council and the residents would have a continuing interest in social harmony. In particular, constant attention would be paid by council to ensure that everybody capable of and wanting work has work. The Town would provide at least some, perhaps temporary, work for those who lose their jobs by action of their external employer. Having nothing gainful to do can be one of the most unsettling experiences, both for the individual and their families. In particular, suitable work should be provided for fit seniors who wish to continue in employment.

Government and commerce policy changes

As far as possible, The Town should seek to be reasonably self sufficient, though given the inevitable desire to continue importing many items it could not possibly make, it will have to export goods and services to pay for them. The concept of importing distantly made products will however become increasingly stymied. Globalisation is the child of cheap oil and using up non-renewables, and will fade without them, its many products simply becoming unavailable. With little left to import, and diminishing means by which to do so, the need for physical exports fades. The Town would need increasingly to concentrate on exports of remotely provided e-services (educational, call centres, help-desk) and products made from renewables, delivered relatively locally: moving bytes of data instead of tonnes of materials.

Some of the Town's exports may be subject to disruption in the event of a change of government bringing to power a party unsympathetic to The Town concept, a commercial decision which affects workers, such as sending remote help desk work overseas to an area of lower pay, or economic changes which leads to a downturn in demand for some services, such as decline in tourist activity.

To protect The Town from such events, residents would probably need to take a far more holistic view of the society they live in than is common today. They would need to be organisationally and politically aware, whether or not they are individual members of any political party.

Philosophy

Each Town should aim to excel in adherence to the rules of indefinite life on a finite planet.

Mission

The mission of The Town is to develop towards a way of life that is physically comfortable, yet totally sustainable and much more socially and environmentally rewarding than today's city/suburban life.

Who would sign up to live there? Given the increasing frustrations of today's city/suburban life, I'm tempted to ask “who wouldn't?” but I'm sure some of the things that would be missing in The Town would hold back certain folk. If, after family, the second love of your life is the classic car in the garage, Sunday's spent washing and polishing it, followed by a drive in the countryside, The Town is not for you!

There may be a few groups who would dearly love to be offered a Town before they drown. There is a population of about the correct amount (~11,000) on a group of islands North East of Australia: Tuvalu. The highest point above sea level anywhere in Tuvalu is about 4,600 … millimetres! Given that Australia has been partly responsible for the fact that it probably will become unliveable early in the 21st century, perhaps the people there should be offered a Town on Australia's mainland. There could be a large number of similar candidates, though they might not be wiling to accept the huge life style change.

Measurement

Genuine Progress Indicator

We seem stuck with Gross Domestic Product (GDP) as a measure of whether our society is improving. Yet GDP puts on the positive side of the ledger such items as medical effort spent on treating smokers for lung cancer, or healing road accident victims. Both are essential efforts, but neither can remotely be considered as a societal improvements. They should be on the debit side of any progress indicator, especially when they are the direct result of unwise behaviour (smoking, drink-driving). The list of such items in the GDP formula is lengthy. There is also a list of activities which do not appear on the positive side of the GDP ledger, but which are extremely beneficial, such as the unpaid efforts of family members and volunteers. A movement, started over two decades ago, began to define a more realistic alternative: the Genuine Progress Indicator. See the USA's Redefining Progress site or at Genuine Progress Indicator and elsewhere. The GPI is summarised as a dollar figure directly comparable with GDP. It has critics and is open to improvement, though this is not the place to debate it. Some country's estimations of their GPI suggest it has flat lined for the last four decades, compared to a rising GDP.
The Town should assuredly rate its progress with some version of a GPI.

Gross National Happiness

The GPI is grounded in economics, though aiming to ensure that the dollar values of activities are placed in the correct column. The Gross National Happiness indicator was invented and used in Bhutan, and though its importance there may now be waning, it serves to emphasise that reducing progress monitoring to purely dollar values is inadequate, and needs expanding by surveying people's sense of wellness on a

sevenfold range of topics: economic, environmental, physical, mental, workplace, social, and political. The Town should probably attempt some similar survey-based measurements.

Certainty

In life, we seek certainty, though we pay can a high price for it, sometimes warranted, sometimes not. We expect water to flow whenever we turn on the tap. We expect there to be enough electricity, even to run a 3-phase air conditioner at the height of a heatwave, just as everybody else does the same. We expect to buy fresh strawberries no matter what the month. We expect to drive quickly to and from work.

To secure the water supplies, and scared by the sinking levels in the dams, early in the 2010 decade, state Australian governments spent billions on desalination plants, ironically just before a wet season poured water over the tops of the dams spillways! If our water is to come from the roof and our tanks, not from massively expensive infrastructure, we have to monitor the level in our stores, and use water frugally, and we may want the insurance plan of having a distant source and The Town's water tanker available.

To secure electricity supply against the highest possible demand, we can beef up the wires and have quickly dispatchable power stations on standby. Or, we could instead rely on the electricity received from the sun and stored in the house's batteries. Again, we need to become aware of the amount in store and use electricity more sensibly, such as by using our more demanding equipment when the sun is at it highest. I think it likely that early Town prototypes would still have solar/wind powered mains electricity.

To buy fresh strawberries whenever we like, we truck them from interstate or fly them in from half a world away when the local season ends. Having *enough* good food always available is vital, but it is time to focus on using extremely local crops and accepting seasonal variation, or food that has been stored. Some foods, such as wheat, potatoes and pumpkin store very well with little cost and equipment.

To drive to work, in addition to funding a car, we collectively demand more and more huge multi-million dollar roads, on which to drive, often alone in a four or more seat vehicle, for about two or more hours per week day. So work locally or at home! No need for the car. No need for the roads. Perhaps a smaller pay packet, but when we add up the totals, we will actually be richer, happier, and healthier. Enjoy.

Gradual build?

How quickly should The Town be built? Clearly, it is not going to happen overnight, but conversely will not work well if its construction drags out over many years, as has been the inevitable fate of most cities.

Here is a great job for town planners and project managers. Obvious first steps after site choice would be to build the feeder road and a few of the commercial and industrial premises, such as a food shop and a house prefabrication factory complex. Next, build some houses so construction workers and their families can get out of trailers into good accommodation. Soon, some schooling and clinics will be needed, and so on. Agriculture might best wait a while, though it would be good to get forestry going as soon as possible. At a financial cost, The Town can survive its early years by importing its food and fibre needs, as do our current cities and suburbs, but it should immediately build up the food land quality.

It would be a fascinating project, related obviously to town planning, but it would be unlike almost all current practice of that profession, which is nearly always incremental rather than scratch-to-finish at top speed. Possible sources of learning would be the creation of Olympic villages, or Brasilia. There might be something to be gained by studying the production of new estates, but few of them would be on anything like the scale of The Town, and are usually supported by nearby existing infrastructure but often with insufficient provision of public facilities in the new estates themselves, to their long term detriment. One possible exception is Springfield, Queensland, Australia, though its planned scale (now 18,000 with a

target of 80,000), primary function (dormitory town for Brisbane workers), and lack of directly associated agriculture means it is not a model for The Town. It is nice to note though that its 2860 hectare site was purchased (1992) for AU$7.9M. Assuming The Town needs 5x that much land (about 1 hectare/resident), and an inflation of 5x since 1992 (a gross over-estimate?); that would price similar land for The Town at an attractive AU$200M, whereas building costs for about 6,000 dwellings might be about AU$2B.

Some roles in a growing Town would become obsolete upon initial completion, when creation changes to maintenance. However, house builders and town planners would continue to have local jobs for the creation of the sister Town. *The Zillion Year Town* is only of value if it is repeated many times, so some trades people and professionals would have the opportunity to move their experience on to other Towns.

Community enhanced

Safety, good health, excellence in education, and social cohesiveness are some of the main keys to The Town's happiness and success. These demand constant effort, particularly attention to its use of physical and social resources and its overall prosperity and balance of payments.

Much of an individual's capital would be invested in Town shares, even though their residence is leased. There would be the usual lessee's incentives to look after the property: caring for their 'nest' and not risking the financial bond! But there are no drivers or opportunities to enhance that property substantially, so people's focus would switch to enhancing their street or The Town as a whole instead of just their individual property.

A Town should also sponsor the growth of sister Towns, firstly its twin on the other side of the highway. A nation cannot be sustainable if it continues to be structured as cities and suburbs ravaging the ever-diminishing supplies of non-renewables and living off distant and sparsely populated, oil-powered, agricultural land that is being constantly mined of its organic and mineral vigour.

“Private affluence, public squalor” is a common complaint, but it would be unlikely in The Town as the entire structure would encourage everybody to work towards common shared goals. Those who would take up the challenge of living in such a way would already lean towards the appropriate mindset, and a key task would be to ensure that future generations learn to share those attitudes.

Individualism suppressed?

Some freedoms lost

There are aspects of the town that do eliminate some individual 'freedoms'. You cannot park a flashy car on your drive, not least because you have no drive. Most residents, most of the time, would not need to use a car at all, and would rent or lease one if the need arose. Even those who need a car nearly full time would probably lease, as that leaves all the issues of ownership to the lessor.

If you really want to own a car, there is nothing to prevent you doing so; it just has to be kept in one of The Town's garages next to the highway. You would need to attend to all the usual government licensing and insurance requirements, as well as arranging maintenance. Many of us are used to such tasks now; I wish I could economically avoid them, but it would be difficult in our present society to go without a car and would seem expensive to take a conventional commercial long-term lease. It will be most interesting to track the long term success or otherwise of car sharing operations such as goget.

In The Town, you cannot build a big extension on the house you live in, as you don't own it. If it is becoming too limited for current needs, move up a size, retaining all the benefits of The Town but incurring next to no capital and removal costs normally associated with buying and selling real estate.

Thus neither you nor your neighbours will have to put up with months of noise, dust and disruption that often occurs during extension works, together with the threat to neighbours' property's quality and value from unexpected over-looking. It is also worth noting that extensions are often cost-ineffective compared to a complete rebuild. And if your home is now larger than you need, move down a size.

Some new freedoms gained

The massive reduction of infrastructure compared to that normally found in cities and suburbs means the cost of living in The Town is dramatically lower, and health is much better. Most people would have fewer work and travel hours, and thus more time for family or cherished pursuits. The Town is designed to eliminate many of today's personal tasks. We are assaulted by too many issues demanding attention, particularly as some office work becomes a 24/7 activity thanks to the mobile phone, tablet, wifi, and 4G.

Acquiring a house demands a massive financial struggle, mortgaged to the hilt, big fees to real estate agents if selling as well as buying, and paying the state government thousands in stamp duty. Then there's maintenance work, and bills, bills, bills. Repairs, water, sewage, electricity, perhaps gas, telecoms, local government rates, insurance. Equipment: refrigerator, hot water system, washing machine, a dishwasher perhaps, ovens and the hob, entertainment systems, computers, and networking.

Where public transport is poor, the work and the lifestyle demands at least one car (maybe more, particularly if the spouse works also, which is probable nowadays). You need to manage: the car's lease payments if it is not yet fully owned, fuel costs (keep your eyes on the local price roller-coaster graph), license renewal, annual inspection, registration, 3rd party or comprehensive insurance, maintenance and bills, and eventually, replacement by a new or newer vehicle when the repair bills get too much.

School at best involves mum's/dad's taxi, and modest fees even in a government school. University today is fee-paying, sometimes based on a relatively low interest government loan with repayments beginning once the student starts work, though mum and dad will often be the lender – at no interest of course!

Finally, and weaving its way through all the above, are the finances. Juggling the various ordinary and credit card accounts, trying always to pay off the credit card in full on the indicated day, to stay away from the ruinous interest rates, typically several times that of a good mortgage. Did I say finally? Wrong. Eventually, you are put through some of the above again, helping your children. Just make sure you have enough superannuation in the bank (or a hard enough heart) to cope with all the demands on your money.

In The Town: most can forget the cars, and walk or cycle to work unless it is actually at home. No mortgage is necessary, though there is nothing to stop you taking a loan to buy Town shares, somewhat equivalent to a property mortgage. The house you occupy, and much of its equipment if you choose to lease, is not yours, so every house-related cost is covered by one simple monthly payment. Extra property investment is achieved by buying more Town shares than you need if you want to zeroise the lease component. Take the children to school? The toddlers - of course - but once they pass kindy there is no reason why they should not get themselves there, perhaps with a sibling or neighbour. I walked to and from (~1km) my infant and junior schools. The only dangerous road, by the school, had a man with a lollipop ('stop - children crossing') sign. There *are* no dangerous roads in The Town, crucial to the design.

Total sustainability?

Prototypes will fall short of total sustainability. Residents would continue to use up non-renewables, but hopefully would reduce their use of non-renewables and fragile renewables, and would come to nurture their total environment, promote those same ideas amongst the rest of the population, including helping to sponsor new Towns. So how should we rework our society so that it becomes elegant and comfortable, but totally sustainable into the future". If you think ***The Zillion Year Town*** is the wrong answer, what's your Plan B? There is no Planet B.